

LITTLE NARRAGANSETT BAY
AND WATCH HILL COVE
PAWCATUCK RIVER PROJECT
RHODE ISLAND & CONN.

SURVEY

(REVIEW OF REPORTS)



U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

OCTOBER 15, 1959

00

SURVEY
(REVIEW OF REPORTS)

LITTLE NARRAGANSETT BAY AND WATCH HILL COVE
PAWCATUCK RIVER PROJECT
RHODE ISLAND AND CONNECTICUT

SYLLABUS

The Division Engineer finds that prospective benefits are sufficient to warrant improvement of Watch Hill Cove, Westerly, Rhode Island. He recommends modification of the existing project for Pawcatuck River to provide for (1) construction of a breakwater 400 feet long across the Watch Hill Cove entrance, (2) enlargement of the existing Watch Hill Cove jetty by extending it 100 feet landward increasing its length from 550 to 650 feet and by raising its top elevation to 8.0 feet above mean low water and (3) extension of the existing anchorage along the south side of Watch Hill Cove by dredging an additional 1.75 acres to a 6-foot depth. The estimated first cost of construction is \$200,000 exclusive of preauthorization study costs of \$3,000 and Federal navigation aids estimated as \$6,000. The recommendation is made subject to certain conditions of local cooperation which include a local cash contribution of 51 percent of the cost of construction of the project modification, estimated at present to be \$102,000. The cost of the work to be borne by the United States is estimated to be \$98,000 with \$2,950 annually for additional maintenance, exclusive of aids to navigation.

TABLE OF CONTENTS

<u>Paragraph No.</u>	<u>Subject</u>	<u>Page No.</u>
1	Authority.....	1
3	Purpose and Extent of Study.....	1
4	Description of Navigation Conditions....	2
12	Tributary Area.....	3
15	Prior Reports.....	4
16	Existing Corps of Engineers Project.....	5
19	Local Cooperation on Existing and Prior Projects.....	6
21	Other Improvements.....	7
22	Terminal and Transfer Facilities.....	7
28	Improvement Desired.....	8
35	Existing and Prospective Commerce.....	10
40	Vessel Traffic.....	12
41	Difficulties Attending Navigation.....	13
42	Water Power and Other Special Subjects..	13
44	Plan of Improvement.....	14
51	Shoreline Changes.....	16
52	Required Aids to Navigation.....	16
53	Estimates of First Cost.....	16
54	Estimates of Benefits.....	18
59	Apportionment of Costs Among Interests..	22
60	Estimates of Annual Charges.....	24
61	Comparison of Benefits to Costs.....	25
62	Proposed Local Cooperation.....	25
64	Coordination with Other Agencies.....	25
65	Conclusions.....	26
69	Recommendations.....	27

401-1111

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM 54, MASS.

NEDGW

15 OCTOBER 1959

SUBJECT: Survey (Review of Reports) of Little Narragansett Bay and Watch Hill Cove, Pawcatuck River Project, Rhode Island and Connecticut.

TO: Chief of Engineers, Department of the Army, Washington 25, D.C.

AUTHORITY

1. This report is submitted in compliance with the following resolution adopted July 31, 1957:

"RESOLVED BY THE COMMITTEE ON PUBLIC WORKS OF THE HOUSE OF REPRESENTATIVES, UNITED STATES, that the Board of Engineers for Rivers and Harbors be, and is hereby requested to review the reports on Little Narragansett Bay and Watch Hill Cove, Rhode Island, submitted in House Document No. 839, Seventy-Sixth Congress, Third Session, with a view to determining if further improvement in the interest of navigation is advisable at this time."

2. A study of survey scope was assigned to the New England Division by the Chief of Engineers on 19 August 1957.

PURPOSE AND EXTENT OF STUDY

3. The principal purpose of the study was to determine the advisability of navigation improvements in Little Narragansett Bay and Watch Hill Cove. Consideration was also given to navigation improvements in the Pawcatuck River, particularly in the vicinity of the Westerly Yacht Club. A field survey was run to locate the shoreline of Sandy Point, Watch Hill Cove and part of Napatree Beach and to locate structures in Watch Hill Cove. Soundings were taken in the Sandy Point breach and in Watch Hill Cove. A historical study was made of the growth of Sandy Point and its encroachment on the entrance channel leading to Little Narragansett Bay and also of the changes occurring in the Sandy Point breach. An economic study was made to determine costs, benefits and justification for proposed improvements. Meetings were held with officials of the Town of Westerly, the Watch Hill Fire District, the Chamber of Commerce and others interested in the harbor improvements. A hearing open to the general public was held in Westerly. Local interests collected and furnished information on the present use of the waterway, desired improvements and the need for the improvements. Details concerning consultation with local interests and information furnished are contained in the section of this report entitled "Improvement Desired."

DESCRIPTION OF NAVIGATION CONDITIONS

4. Little Narragansett Bay is located at the Rhode Island - Connecticut boundary at the mouth of the Pawcatuck River in the Town of Westerly, Rhode Island. The bay is roughly square in shape and has an area of approximately $1\frac{1}{2}$ square miles. It is separated from Block Island Sound to the south by Napatree Beach and from Fisher's Island Sound to the west by a breached sand spit known as Sandy Point. The breach has existed since it occurred during a hurricane in 1938 and the spit north of the breach has since migrated northward encroaching upon the navigation channel. Watch Hill Cove is located in the southeast corner of Little Narragansett Bay. It has a water area of approximately 25 acres of which about 15 acres have been dredged to a depth of 10 feet to provide an anchorage.

5. The entrance channel into Little Narragansett Bay from Fisher's Island Sound passes through Stonington outer harbor and north of Sandy Point. It is connected with the Pawcatuck River by a channel running southeasterly along the north side of Little Narragansett Bay. This channel which has been improved to a depth of 10 feet and a width of 100 feet had a controlling depth in April 1959 of slightly less than 10 feet with shoals in the channel at elevation 2.4 feet above mean low water in the vicinity of Sandy Point and at depths elsewhere of 6.9 feet. Another channel running southerly along the east side of Little Narragansett Bay from deep water in the vicinity of the Pawcatuck River entrance to Watch Hill Cove has also been improved to a width of 100 feet and a depth of 10 feet and it had a controlling depth of 10 feet limited to a width of about 65 feet in April 1959. The Pawcatuck River discharges into Little Narragansett Bay. A navigation channel up the river 100 feet wide diminished to 40 feet in the vicinity of the wharves at Westerly has been improved to a depth of 10 feet. In April 1959 a controlling depth of 10 feet existed for a width of only 30 feet within the limits of the originally improved 100 foot channel and the maximum depth in part of the 40-foot channel was 9.2 feet.

6. Another entrance into Little Narragansett Bay was created by the breaching of Sandy Point. In September 1958 the breach had a width of 2,600 feet, a maximum depth of about 6 feet and a controlling depth between 2 and 3 feet below mean low water.

7. There are no bridges across the waterways under consideration. The area is practically landlocked except for the exposure through the Sandy Point breach from Fisher's Island Sound to the west. The size of incoming waves is limited by the shallow depths in the breach. The longest fetch within the harbor is about two miles in a northwest-southeast direction between the Little Narragansett Bay entrance and Watch Hill Cove. No information is available on observed wave sizes.

It has been estimated, using wave forecasting methods, that three (3) foot waves can be generated in Watch Hill Cove by northwest winds across the existing fetch within Little Narragansett Bay. Depths in the channel in the breach through Sandy Point are large enough to permit larger waves to enter Little Narragansett Bay from Fishers Island Sound to the west but wave refraction and breaking of waves on existing shoals probably limit the size of these waves so that they do not exceed those which are generated within the bay. Winds with speeds of 32 miles per hour or higher from the north, northwest and west, the directions from which winds can cause the most severe wave disturbance in Watch Hill Cove, occur on an average of about four times during the 5-month period, May to September, inclusive. Winds from the same directions of 19 miles per hour and higher which reportedly make it dangerous to use tenders or to lie alongside of piers and wharves in Watch Hill Cove occur, on an average, about 30 times during the period May - September, inclusive.

8. Littoral drift moves westward along the seaward side of Napatree Beach, northward from Napatree Point towards the tip of Sandy Point, eastward through the Sandy Point breach into Little Narragansett Bay and eastward along the bay side of Napatree Beach into Watch Hill Cove.

9. The mean range of tide varies from about 2.7 feet in Little Narragansett Bay and Watch Hill Cove to 2.5 feet at Westerly and the Spring range varies from about 3.2 to 3.0 feet, respectively. The maximum tide of record was 11.7 feet above mean low water at Stonington and 12.0 feet at Westerly. The minimum tide is estimated as 2.5 feet below the plane of mean low water.

10. The waterway is used principally for recreational boating, concentrated in the vicinity of Watch Hill Cove and at the Westerly Yacht Club on the Pawcatuck River. Commercial shipping is limited to the Pawcatuck River. It consists of transport of petroleum by barges to a terminal at Pawcatuck and to use of the river by about a dozen individual fishermen operating small fishing boats. Details concerning present harbor use are contained in Paragraphs 35 to 40 of this report entitled "Existing and Prospective Commerce" and "Vessel Traffic".

11. The locality is shown on United States Coast and Geodetic Survey Chart No. 358 and on Plates 1 and 2 accompanying this report.

TRIBUTARY AREA

12. The immediate tributary area consists of the towns of Westerly, Rhode Island and Stonington, Connecticut and in particular the communities at Watch Hill, Westerly, Pawcatuck and Stonington. The 1950 populations of the towns of Stonington and Westerly were 11,801 and 12,380, increases of about 7% and 2% respectively since 1940.

13. Watch Hill is a popular summer resort. Watch Hill and the nearby territory contain a large number of residences and hotels used exclusively for the summer trade. This results in a large seasonal population increase. Manufacturing industries in the adjacent communities of the village of Stonington, Pawcatuck and Westerly employ a large percentage of the labor force. The industries include textiles, machinery, apparel, food, metal, plastic and paper products, soaps, marine engines, electronic equipment, boats, toys, instruments and printing.

14. Westerly and Stonington are served by the main line of the New York, New Haven and Hartford Railroad between Boston and New York. The area is accessible over the United States Highway Route 1, Connecticut Highway Routes 2,3 and 95 and over town roads. There is a State airport in Westerly.

PRIOR REPORTS

15. There have been thirteen prior reports on the Pawcatuck River, Little Narragansett Bay and Watch Hill Cove. Reports containing information about prior and the existing projects and about Little Narragansett Bay and Watch Hill Cove, pertinent to this study, are listed below:

<u>Report Date</u>	<u>Type</u>	<u>Publication</u>	<u>Recommendation</u>
Jan 17, 1871	Survey	H.Ex.Doc. No.60 41st Cong.3d Sess.	Favorable to 5' channel in the Pawcatuck River from Certain Draw Point to Westerly.
Nov 30, 1875	Survey	H.Ex.Doc. No.70 44th Cong.1st Sess.	Favorable to a 200'x7½' channel along the north shore of Little Narragansett Bay and removal of rocks at Watch Hill Landing.
Jan 24, 1885	Survey	H.Ex.Doc No.183 48th Cong.2nd Sess.	Favorable to 8' channel in the river 100 feet wide from lower wharves at Westerly down to deep water and 40' wide from the lower to the upper wharves.
Nov 26, 1886	Prelim. Exam.	H.Doc. No. 58 50th Cong.1st Sess.	Unfavorable to removal of shoals in the channel to and west of wharves in Watch Hill Cove

<u>Report Date</u>	<u>Type</u>	<u>Publication</u>	<u>Recommendation</u>
Dec 19, 1890	Prelim. Exam.	H.Ex.Doc No. 174 51st Cong. 2nd Sess.	Unfavorable to dredging a channel in the southeast part of Watch Hill Cove.
Nov 16, 1895	Survey	H.Doc. No. 62 54th Cong. 1st Sess.	Favorable to a 10-foot channel from Stonington to Westerly, 200-feet wide to Avondale, 100-feet wide from Avondale to the lower wharves at Westerly and 40-feet wide to the upper wharves.
May 15, 1936	Prelim. Exam.	Not Published	Favorable to a survey study of Watch Hill Cove and approach channels in Little Narragansett Bay.
Aug 8, 1939	Survey	H.Doc. No. 839 76th Cong. 3d Sess.	Favorable to a 100x10-ft. channel from the vicinity of the Pawcatuck River entrance to and a 16-acre 10-foot anchorage in Watch Hill Cove. Favorable to a 200-foot jetty at the cove entrance. Unfavorable to an entrance channel through the Sandy Point breach.

EXISTING CORPS OF ENGINEERS PROJECT

16. The original project and its extensions up to the time of adoption of the existing project in 1896 for the present channel dimensions in Little Narragansett Bay and the Pawcatuck River were not defined by River and Harbor Acts. They followed plans presented in special reports to the Chief of Engineers, funds for the execution of which were subsequently appropriated. The original plan of improvement recommended a channel in the Pawcatuck River having a depth of 5 feet at mean low water and a width of 75 feet extending from Certain Draw Point to Westerly (H.Ex. Doc. No. 60, 41st Cong., 3rd Sess.). Between 1871 and 1875 the river was deepened to $5\frac{1}{2}$ feet with a width of 75 feet below the lower wharves at Westerly and 35 to 40 feet between the lower and upper wharves. The project was subsequently extended to provide a channel through Little Narragansett Bay $7\frac{1}{2}$ feet deep and 200 feet wide (H.Ex. Doc. No. 70, 44th Cong., 1st Sess.). Another extension to the project to provide a channel 8 feet deep and 100 feet wide from the lower wharves at Westerly down to deep water, and 40 feet wide from the lower to the upper wharves was recommended in a report in 1885, (H.Ex.Doc. No. 183, 48th Cong., 2nd Sess.).

17. Funds appropriated by the River and Harbor Act of August 5, 1886 and subsequent acts were applied to these extensions. The amount expended on the above, prior to operations on the existing project, was \$97,500.

18. The existing project was authorized by the following River and Harbor Acts:

<u>Acts</u>	<u>Work Authorized</u>	<u>Documents</u>
June 3, 1896	Present dimensions from Stonington to Westerly	H.Doc. 62, 54th Cong., 1st Sess.
Mar 3, 1905	Removal of obstruction near Watch Hill	Specified in Act
Mar 2, 1945	Channel, anchorage and jetty at Watch Hill Cove	H.Doc. 839, 76th Cong., 3rd Sess.

The existing project provides for a channel in Little Narragansett Bay and in the Pawcatuck River 10 feet deep at mean low water, 200 feet wide from Stonington to Avondale, about 4 miles; 100 feet wide from Avondale to the lower wharves at Westerly, about 3 miles; and 40 feet wide between the lower and upper wharves at Westerly, about one-half mile; for the removal of obstructions at Watch Hill; for a channel 10 feet deep and 100 feet wide from the mouth of the Pawcatuck River into Watch Hill Cove; for an anchorage basin in the cove 10 feet deep and about 16 acres in area; and for a riprap jetty 200 feet in length near the southwest corner of the basin. Expenditures on the existing project to June 30, 1958 were \$181,777 for new work exclusive of \$20,000 contributed by local interests and \$253,877 for maintenance. The latest (1950) approved estimate for annual cost of maintenance is \$5,000. The cost of maintenance for the six year period including fiscal years 1950 through 1955 averaged \$8,120 per year, principally for dredging 29,719 cubic yards of ordinary material from the entrance channel in the vicinity of Sandy Point. This maintenance cost is believed to be largely due to the breaching of Sandy Point and its subsequent northward drifting and encroachment on the navigation channel. The existing project is about 70 percent complete. Completion of the project requires widening of the main channel in Little Narragansett Bay and in the Pawcatuck River up to Avondale from its improved width of 100 feet to the authorized project width of 200 feet. It also requires removal of rock at Pawcatuck Rock and in the vicinity of Rhodes Folly Light.

LOCAL COOPERATION ON EXISTING AND PRIOR PROJECTS

19. The River and Harbor Act of March 2, 1945 authorized the channel to and the anchorage and jetty at Watch Hill Cove subject to

the conditions that local interests furnish free of cost to the United States, suitable spoil disposal areas for the initial work and subsequent maintenance when as required, and contribute in cash 40 percent of the first cost of the work not to exceed \$20,000. These requirements were met at the time of project construction in 1948-1949.

20. There were no requirements for local cooperation in connection with prior projects. However, in 1875 wharf owners offered to contribute one-half of the expense, for dredging a channel along the wharves at Westerly, a distance of 2,400 feet beyond the upper end of the previously improved channels. This additional work was approved and accomplished during 1875-1876 with a local contribution of about \$2,000.

OTHER IMPROVEMENTS

21. Local interests spent about \$18,000 for removing boulders and easing bends in the river channels in 1929. Other improvements in and about Watch Hill Cove made by local interests consisted of removal of obstructive boulders, construction of timber piers and a wharf, annual removal of drifting sand for mooring landing floats, maintenance of channel markers as aids to navigation during the summer and construction of a concrete seawall extending 1,700 feet along the waterfront. They also extended the jetty at the southwest corner of the cove 350 feet in 1951 at a cost of \$9,000. In all, the Watch Hill Fire District has reportedly spent \$100,000 on parks, docks, seawalls and walks.

TERMINAL AND TRANSFER FACILITIES

22. There are one private and three public landings, all of open pile timber construction in Watch Hill Cove. The public landings belong to the Watch Hill Fire District, a political subdivision of the Town of Westerly. They consist of two T-head piers and a wharf. One pier close to the improved anchorage has a frontage of about 90 feet in a depth of about 6 feet and the other 50 feet from the improved anchorage has a frontage of about 55 feet also in a depth of 6 feet. Depths decrease gradually from the heads of piers toward the shore. The wharf located 100 or more feet landward of the improved anchorage has a 170 foot frontage in a depth of 4 feet throughout its length. The private landing is a T-head pier belonging to the Watch Hill Yacht Club. It has a 100-foot frontage in a depth of 6 feet close to the improved anchorage. This depth decreases rapidly from the head of the pier toward the shore.

23. The only navigation structures or facilities in Little Narragansett Bay consist of a few private piers at residences along the shore north of Watch Hill Cove.

24. There are a number of landings in the Pawcatuck River. The Westerly Yacht Club located about $2\frac{1}{2}$ miles upstream on the Rhode Island side of the Pawcatuck River has 4 timber piers with 80 mooring piles in a depth of 10 feet and two anchorages, each 200 feet by 500 feet one with a depth of 6 feet the other with a depth of 10 feet. There are two public landings, one known as the Greenhaven Dock, the other as the Town of Westerly Dock. The Greenhaven Dock belongs to the Town of Stonington and it is located on the west shore of the river in Lower Pawcatuck. The Town of Westerly Dock belongs to the Town of Westerly and it is located on the east shore of the river in Avondale. There are four private landings. They are (1) the Shell Oil Company Dock (Gencarelli Coal and Oil Company) with a 500-foot frontage and 500,000 square feet of bulk oil storage facilities, (2) the former Standard Oil Company Dock with a 200-foot frontage, truck access and water and fuel, (3) the Wilcox Dock and the (4) the Hiscox Dock.

25. All landings described above as public are open to all on equal terms. The yacht club piers are used by members and guests. The Standard Oil Company Dock is operated as a commercial landing open for general use.

26. There are five (5) boat yards on the Pawcatuck River located as follows: three in Avondale, one in Lower Pawcatuck and one in Pawcatuck. The yards in Avondale have a total of six (6) marine railways of the following capacities: two of 5 ton, one of 10 ton, two of 15 ton and one of 50 ton. They have combined storage areas which can hold 235 boats. The yard in Lower Pawcatuck has one marine railway of 4 ton capacity and an open storage area for 500 boats. The yard in Pawcatuck has a travel lift of 20 ton capacity and an open storage area for 50 boats.

27. Fresh water, fuel and electricity are available at the landings in Watch Hill Cove and foodstuffs and supplies can be obtained in nearby stores. There are no direct rail connections to the waterway. Hard surfaced roads extend from the principal highways to landings in the cove and river.

IMPROVEMENT DESIRED

28. A meeting was held with officials of the Town of Westerly and the Watch Hill Fire District, businessmen and representatives of boating interests on January 30, 1958 at Westerly, Rhode Island to discuss the navigation study, initiate collection of pertinent information and to make arrangements for a public hearing. A public hearing was held at the Town Hall in Westerly on June 16, 1958 to afford local interests an opportunity to express their views concerning the character extent, need and advisability of any improvement desired and to permit presentation of pertinent factual information. The hearing was attended by 58 people representing Federal, State and local governments, business and boating interests and local residents.

29. There was broad general support by local interests for the following proposed improvements at Watch Hill Cove:

a. Construction of a breakwater 400 feet long across the cove entrance starting about 75 feet off Battey's Point and extending to a point 80 feet from the existing channel.

b. Extension of the existing jetty 100-feet shoreward and increasing its height 3 feet.

c. Dredging a shoaled area east of the jetty along the south shore of the cove to a 6-foot depth.

d. Construction of riprap protection along the south shore of the cove.

30. The following reasons were given for the above improvements in Watch Hill Cove:

a. To provide better protection for dock and anchorage areas against west and northwest winds which now make it hazardous to use tenders and lie alongside the piers and wharf.

b. To prevent shoaling along the south shore of the cove by drifting sand. This now requires annual dredging to permit mooring of landing floats at the Watch Hill Yacht Club and it results in loss of revenue from wharfage to the Watch Hill Fire District.

c. To increase the size of the anchorage area which is now crowded throughout the season.

d. To protect parks, piers, wharf, seawalls and walks, from wave action which causes recurring costly damages.

e. To provide shelter to make it possible for vessels to lie in safety in slips. Construction of a marina has been considered by the Watch Hill Fire District. Such an improvement would require the shelter to be obtained from the proposed breakwater.

f. To permit more profitable utilization of the area. The area has deteriorated so that larger boats which bring more business into Watch Hill have difficulty using existing facilities, and are therefore discouraged from using the harbor. In this connection there is reportedly a trend toward larger boats which need more protection for proper anchoring.

31. The Westerly Yacht Club requested widening of the Pawcatuck River channel and removal of a shoal located between the channel and the Yacht Club anchorage. Transient yachts in particular now have difficulty in this area frequently running aground. The improvement would also make navigation easier for local yachtsmen.

32. Other improvements suggested by individuals without general support, consisted of removal of rocks and dredging of Potter, Colonel Willie, Babcock and Thompson Coves, dredging a channel through the Sandy Point breach and construction of a jetty to prevent sand from filling this channel.

33. There was widespread interest in obtaining maintenance dredging of the existing Federal project navigation channels through Little Narragansett Bay and the Pawcatuck River to facilitate navigation by pleasure and commercial craft which frequently experience difficulty in using the waterway.

34. There were a few individuals in favor of keeping the Sandy Point breach open as a short route in and out of Little Narragansett Bay for small pleasure and fishing craft and for increased flushing of the bay and river. Town officials, business interests and shore property owners who are affected by flooding and consequent damages due to higher tides and currents favored closing of the breach.

EXISTING AND PROSPECTIVE COMMERCE

35. There is no commercial shipping in Watch Hill Cove. Commercial shipping on the Pawcatuck River passes through Little Narragansett Bay enroute to and from Westerly and Pawcatuck. The tonnage reported for the 11 year period 1947 - 1957 is included in Table 1 below.

TABLE 1

Waterborne Commerce on the Pawcatuck River				
Year	T O N S			
	Shellfish	Petroleum	Coal	Total
1947	-	10,969	4,023	14,992
1948	2	15,849	3,672	19,523
1949	8	17,278	-	17,286
1950	1,155	21,566	-	22,721
1951	10	20,494	-	20,504
1952	10	14,975	-	14,985
1953	10	17,349	-	17,359
1954	4	10,525	-	10,529
1955	10	6,289	-	6,299
1956	5	5,549	-	5,554
1957	27	4,924	-	4,951

According the above tabulation the volume of the commerce in the Pawcatuck River has been declining in recent years. The Gencarelli Oil and Coal Company, the principal commercial user of the waterway, has indicated that the present lack of maintenance of the existing project channel may drastically affect their shipments. The company also has indicated that additional shipments could be used which are not now made because of lack of depth to accommodate available barges.

36. Local interests furnished the information in Table 2 concerning recreational craft which use Watch Hill Cove as a home port. This includes 63 craft which comprise the Watch Hill Yacht Club fleet.

TABLE 2

Recreational Craft - Permanent Locally Based Fleet at Watch Hill Cove

Type	Length(Feet)	No. of Craft	Total Market Value
Rowboats	-	110	\$7,000
Outboards	8-20	55	42,500
Inboards	10-25	13	46,000
Cruisers	15-50	22	387,000
Cruisers	51-60	1	45,000
Auxiliary Sail	15-30	2	5,000
Auxiliary Sail	30-80	15	452,000
Sail	10-30	<u>52</u>	<u>132,000</u>
Total		270	\$1,116,500

37. Local interests furnished the list of transient recreational craft in Table 3. The list was prepared from the wharfage records of the Watch Hill Fire District landings and represents an estimated one-third of all transient recreational craft which moored in Watch Hill Cove during one season.

TABLE 3

Recreational Craft - Part of Transient Fleet at Watch Hill Cove

Type	Length (Feet)	No. of Craft	Total Market Value	Average No. Days in Port
Cruisers	15-30	25	\$125,000	2
Cruisers	31-50	154	4,520,000	3
Cruisers	51-60	25	270,000	2
Cruisers	61-100	16	1,345,000	5
Aux Sail	31-40	8	151,000	3
Aux Sail	41-60	<u>8</u>	<u>206,000</u>	2-8
Total		236	\$6,617,000	

38. There are 134 recreational craft permanently based at the Westerly Yacht Club on the Pawcatuck River and 50 transient boats which use the Yacht Club facilities annually. The total market value of the permanently based fleet is \$325,000. The composition of the home fleet is shown in Table 4.

TABLE 4

Recreational Craft - Permanent Locally Based Fleet at Westerly Yacht Club

Type	Length (Feet)	No. of Craft
Outboards	12-18	72
Inboards	15-22	15
Cruisers	20-44	35
Auxiliary Sail	38-44	2
Sail	14-18	10
Total		134

39. According to local interests, the proposed improvements in Watch Hill Cove will result in increased use of the harbor by recreational craft. Quantitative information concerning increased use could not be furnished.

VESSEL TRAFFIC

40. No information is available on the number of trips made by recreational vessels. The character and size of recreational craft using the waterway are described in the preceding paragraphs under Existing and Prospective Commerce. The commercial vessel traffic in the Pawcatuck River is indicated by statistics compiled by the Corps of Engineers for the years 1948 - 1956. The statistics are included in Table 5.

TABLE 5

Vessel Trips on the Pawcatuck River

Draft	1948	1949	1950	1951	1952	1953	1954	1955	1956	Average Annual
13	1		1							0.2
12	1		7	2						1.1
11				1	7	8	9	1	2	3.1
10	3	7	20	8	9	9	4	15	4	8.8
9	19	17	25	35	19	20	2	3	6	16.2
8	27	22	4		1			3	2	6.6
7	3		1	11	1				2	2.0
6	7									0.8
5	2	1	82	27	37	76	6	54	83	40.9
4	74	36	19	29	37	76	6	56	83	46.2
3	2	1	1		3	5	6			2.0
2	9	2				2				1.4
Total	148	86	160	113	114	196	33	132	182	129.3

DIFFICULTIES ATTENDING NAVIGATION

41. Local interests have furnished the following information on the difficulties attending navigation.

a. West and northwest winds create a chop which makes it hazardous to use tenders or lie alongside docks in Watch Hill Cove. This condition results in damages to craft tied or moored in the cove.

b. Sand drifts into the cove and causes shoaling. This necessitates annual dredging for mooring of floats at the Watch Hill Yacht Club. The sand encroachment has reportedly reduced by 30-40 percent the revenue derived by the Watch Hill Fire District from wharfage during the past ten years. The area has deteriorated so that larger boats experience difficulties using the existing facilities.

c. The anchorage in Watch Hill Cove is crowded throughout the season. It is too small to accommodate all of the vessels which would use it.

d. Recurring damages occur to docks, walls, walks and parks around the cove due to wave attack.

e. Craft frequently run aground due to shoals, rocks or the narrowness of channels in Little Narragansett Bay and the Pawcatuck River. Exceptional difficulties are experienced in the vicinity of Sandy Point and Pawcatuck Point. Numerous visiting yachtsmen have reportedly run aground on a shoal formed between the Pawcatuck River channel and the Westerly Yacht Club anchorage. This shoaling has made guest moorings unusable. The difficulties in navigating the existing channels deters many visiting yachtsmen from using the waterway.

f. Lack of depth limits use of the bay and river channels for commercial shipping. During 1957, 7 barges drawing 9 feet used the Pawcatuck River channel only at high tide and partly loaded. Additional shipments were not made due to unavailability of shallow draft barges.

WATER POWER AND OTHER SPECIAL SUBJECTS

42. There are no matters concerning water power, water supply or irrigation pertinent to this investigation. Tidal flooding of low developed land areas along the Pawcatuck River reportedly occurs as a result of an increase in the range of tides due to the breach in Sandy Point. The breach has reportedly had a beneficial effect on pollution in the Pawcatuck River and Little Narragansett Bay due to increased flushing. There is a conflict of interests regarding closure of the breach between those desiring protection against flooding and those concerned with dissipation of pollution and a shorter route into the bay usable by small pleasure boats.

43. A study has been made which considered provision of protection against hurricane damages. The report on this study entitled "Interim Report on Hurricane Survey, Pawcatuck, Connecticut" dated 6 October 1958 has been submitted to the Chief of Engineers. Construction of barriers along Napatree Beach and Sandy Point and also across the Pawcatuck River in the vicinity of Pawcatuck Rock were considered for protection against hurricane tidal flooding. It was determined that these structures were not economically justified and that no general over-all protection plan was feasible. A plan involving construction of a dike and wall around a localized industrial section of Pawcatuck for protection against tidal flooding was found to be justified and its authorization was recommended.

PLAN OF IMPROVEMENT

44. Consideration was given to improvements in the Pawcatuck River in the vicinity of the Westerly Yacht Club, to closure of the breach through Sandy Point and to improvements in Watch Hill Cove the latter consisting of construction of a breakwater, enlarging the existing jetty, dredging an extension to the anchorage and construction of shore protection adjacent to this anchorage extension.

45. In connection with the requested Pawcatuck River channel widening and removal of shoals between this channel and the Westerly Yacht Club it was determined that use of the area is now limited to club members and their guests. There is no public landing or other facilities for general public use. Inquiry was made in writing to the interested local group to determine if a public landing and other facilities necessary to insure public use would be provided if the improvement which they desired was made. Local interests did not furnish any information to indicate that the necessary public facilities would be provided and it was therefore assumed that the present limited use would be continued. It was therefore considered inadvisable, under existing Federal policy, to consider further the desired Federal improvement of this area.

46. Two methods of closing the breach through Sandy Point were considered. One consisted of restoration of the breached sand spit by direct placement of sand fill to be obtained by hydraulic dredging in the shoaled area adjacent to the breach. The other method consisted of construction of a stone dike. The sand fill closure involves placement of sand fill up to a top elevation of 6.5 feet above mean low water, top width of 50 feet and side slopes of 1 vertical to 20 horizontal. The top elevation was selected to correspond with the general top elevation of the existing adjacent portions of Sandy Point. The side slopes were similarly selected so as to be not steeper than the slopes of the adjacent portions of Sandy Point. The top width of 50 feet was selected as not less than that of the adjacent sand spit. A cross section of stone dike was selected with

a top width of 5 feet, side slopes of 1 vertical to 1.5 horizontal and top elevations of 6.5 feet above mean low water. A top width of 5 feet was selected as the minimum in which coverstones of adequate size could be used. The top elevation corresponds to that of the adjacent sand spit, and the side slopes are the steepest considered desirable for this type of structure.

47. Extension of the anchorage by dredging along the south shore of Watch Hill Cove to a depth of 6 feet below mean low water was considered in accordance with the desires of local interests to provide needed mooring area. A modification of the shore limits of the anchorage extension proposed by local interests was made in order to maintain a minimum distance of 60 feet from the existing sea wall to prevent undermining. The anchorage extension considered would provide an additional 1.75 acres of mooring area. Location of the anchorage extension along the south side of the cove was selected to take advantage of the more economical dredging of this sandy area as opposed to the more difficult dredging of bouldery areas on the north side.

48. Construction of a stone breakwater across the Watch Hill Cove entrance 400 feet long to a top elevation of 8.0 feet above mean low water was considered in accordance with the desires of local interests to provide needed shelter against wave attack. A modification of the top width of 2 feet and side slopes of 1 on 1 as proposed by local interests to a top width of 5 feet and side slopes of 1 on 1.5 was made. A top width of 5 feet is considered to be the minimum and a slope of 1 on 1.5 is considered to be steepest which should be used for this type of structure.

49. Landward extension of the Watch Hill Cove jetty to its intersection with the existing beach and raising the jetty to an elevation of 8.0 feet above mean low water was considered in accordance with the desires of local interests to provide a barrier to the littoral transport of beach material which drifts into the cove and to provide needed shelter against wave attack. The enlarged jetty would have a length of about 650 feet, about 100 feet longer than the existing jetty, a top width of 5 feet and side slopes of 1 on 1.5. Local interests had proposed a top width of 2 feet and side slopes of 1 on 1 but these dimensions were modified for reasons included in the preceding paragraph for similar modification of the breakwater dimensions.

50. Construction of stone revetment for protection of the south shore of Watch Hill Cove adjacent to the proposed anchorage extension, desired by local interests, was not considered advisable. The proposed revetment would provide a steep surface (1 on 3) which it is believed would reflect waves entering the cove between the jetty and proposed breakwater and would increase the height of waves within the anchorage.

Wave reflections from the existing sea walls around the cove are believed to be partly responsible for the wave action which now makes mooring difficult. A sandy beach with a natural slope would be preferable since it would act as a wave absorber by dissipating wave energy.

SHORELINE CHANGES

51. The proposed landward extension and raising of the existing jetty at Watch Hill Cove is expected to result in accretion of the shore of Little Narragansett Bay adjacent to and west of it by the impounding of littoral drift. The results of this accretion will be confined to the landward shore of Napatree Beach. The principal effect of proposed closure of the breach through Sandy Point will be to retard the rapid shoreline changes which are now occurring to Sandy Point. These changes are shown on Plate 2, and consist of the continued northward growth of the tip of Sandy Point and the increase in the size of the breach. Sandy Point has a history of northward growth. It has grown at the following rates; $62\frac{1}{2}$ feet per year from 1839 to 1855; $32\frac{1}{2}$ feet per year from 1855 to 1875; 31 feet per year from 1875 to 1939; 43 feet per year for 1939 to 1958. The breach through Sandy Point occurred in September 1938 about 8 months prior to the 1939 survey. The width of the breach was 700 feet in 1939, 2,200 feet in 1946, 2,700 feet in 1948 and 2,600 feet in 1958. The rate of growth of Sandy Point decreased prior to occurrence of the breach as the width of the opening between the end of the point and the mainland shore decreased, and it increased after the breach when the tidal flow could pass through two openings. Closure of the breach would probably result in a decrease in the rate of northward growth of the point.

REQUIRED AIDS TO NAVIGATION

52. The United States Coast Guard has been consulted in regard to the establishment of necessary aids to navigation for the proposed improvements in Watch Hill Cove. Information furnished indicates that two of four existing buoys would be discontinued and a new light would be built on the end of the enlarged existing jetty. The first cost of the above is estimated as about \$6,000 and the annual maintenance cost as \$300.

ESTIMATES OF FIRST COST

53. Estimates of first costs have been made for (a) closure of the Sandy Point breach with sand fill, (b) closure of the Sandy Point breach with a rock dike, (c) improvement of Watch Hill Cove by construction of a 400-foot breakwater across the Watch Hill Cove entrance, construction of a 100-foot landward extension to the existing Watch Hill Cove jetty to increase its length to 650 feet, raising the top

elevation of the jetty, and dredging of a 6-foot anchorage extension with an area of 1.75 acres along the south shore of Watch Hill Cove. Estimates are based on prices prevailing in October 1959.

a. Closure of Sandy Point Breach with Sand Fill:

<u>Project Construction</u>	
Placement of 550,000 cubic yards of dredged sand fill @ \$0.90	\$569,000*
Engineering and Design	17,000
Supervision and Administration	44,000
Total Project Construction Cost	\$630,000
Preauthorization Study Costs	3,000
Total Cost	\$633,000

* Includes contingencies

b. Closure of Sandy Point Breach with Rock Dike:

<u>Project Construction</u>	
Construction of rock dike, 30,000 tons @ \$8.00	\$276,000*
Engineering and Design	8,000
Supervision and Administration	21,000
Total Project Construction Cost	\$305,000
Preauthorization Study Costs	3,000
Total Cost	\$308,000

* Includes contingencies

c. Watch Hill Cove Improvements:

<u>Project Construction</u>	
Construction of 400-foot breakwater, 9,200 tons @ \$10.00	\$105,000*
Extension and raising of jetty, 2,300 tons @ \$8.00	21,000*
Dredging 1.75 acre, 6-foot anchorage extension, 23,000 c.y. @ \$2.00	53,000*
	\$179,000
Engineering and Design	7,000
Supervision and Administration	14,000
Total Project Construction Cost	\$200,000
Aids to Navigation	6,000
Preauthorization Study Costs	3,000
Total Cost	\$209,000

*Includes contingencies

ESTIMATES OF BENEFITS

54. General. - Benefits have been estimated for the improvement of Watch Hill Cove for recreational craft by construction of a breakwater, enlarging of the jetty and dredging of an anchorage extension. An estimate has also been made of the benefit from reduction of shoaling in the Little Narragansett Bay entrance channel which may result from closure of the Sandy Point breach. Benefits can also result from the Watch Hill Cove improvements by provision of sufficient protection against wave attack to permit development of marina type facilities, desired by local interests, but now considered impractical due to the existing exposure. Plans for this type of development are not specific enough to permit evaluation of benefits. Other benefits from closure of the breach will accrue to recreational craft in Little Narragansett Bay. These consist of protection against waves which can now enter the bay from Fishers Island Sound and prevention of loss of usable mooring area now occurring as a result of shoaling and migration of Sandy Point. Information is not available to permit evaluation of the benefits in Little Narragansett Bay.

55. Recreational Benefits from Watch Hill Cove Improvements. - Recreational benefits have been estimated as an incremental increase in the annual net return to the present home and transient fleet and as the total annual net return to the additional craft will join the home and transient fleet because of the proposed improvements. Benefits are based on an annual net return to the owners taken as the amount the owners would receive if the boats were let out on a for-hire basis. Due to (a) the exposure to wave attack, and the consequent damages to boats and the extra care and expense to insure safe mooring, (b) to shoaling of portions of Watch Hill Cove by drifting sand which permits only limited use of these areas, and (c) to overcrowding, the actual net return to boat owners is less than the ideal return. It is estimated that the proposed improvements will result in a larger return closer to the ideal evaluated as an incremental increase equal to 5 to 10 percent of the present net return. This benefit for the present home fleet is evaluated in Table 6 with a reduction for the time the fleet is away from its home port. The incremental benefit for the present transient fleet is evaluated in Table 8. The proposed anchorage extension will result in a 9 percent increase in the available mooring area. The benefit from this increase in area is evaluated based on a 9 percent increase in the size of the home and transient fleets. The benefit is evaluated as the total net return which owners of these additional boats will receive. The evaluation for the new boats in the home fleet is made in Table 7 and that for the additional transient craft is made in Table 8.

TABLE 6

Benefits to Present Locally Based Recreational Craft

Type of Craft	Length (Feet)	No. of Boats	Depreciated Value		Percent Return				Value \$	On Cruise		
					Ideal	% of Ideal		Gain		Avg. Days	% of Season	Value \$
			Average	Total		Pres.	Future					
Recreational Fleet												
Outboards	10-20	55	\$750	\$41,250	13	90	95	0.65	270	0	-	-
Inboards	10-20	13	3,500	45,500	11	90	95	0.55	250	0	-	-
Cruisers	15-50	19	19,500	370,500	8	80	90	0.8	2,960	10	5.6	170
Cruisers	51-60	1	45,000	45,000	8	80	90	0.8	360	10	5.6	20
Aux Sail	15-30	2	2,500	5,000	9	90	95	0.45	20	0	-	-
Aux Sail	31-80	15	30,000	450,000	8	80	90	0.8	3,600	10	5.6	200
Sailboats	10-30	52	2,500	130,000	11	90	95	0.55	720	0	-	-
Charter Boats												
Cruisers	21-35	2	5,000	10,000	15	80	90	1.50	150	0	-	-
Cruisers	36-50	1	7,000	7,000	15	80	90	1.50	100	0	-	-
Totals		160		\$1,104,250					\$8,430			\$390

Total Benefit = \$8,430 - 390 = \$8,040

TABLE 7

Benefits to New Locally Based Recreational Craft

Recreational Fleet												
Outboards	10-20	5	\$750	\$3,750	13	-	95	12.3	460	0	-	-
Inboards	10-20	1	3,500	3,500	11	-	95	10.4	360	0	-	-
Cruisers	15-50	2	19,500	39,000	8	-	90	7.2	2,800	10	5.6	150
Aux Sail	31-80	1	30,000	30,000	8	-	90	7.2	2,160	10	5.6	120
Sailboats	10-30	5	2,500	12,500	11	-	95	10.4	1,300	0	-	-
Charter Boats												
Cruisers	21-35	1	5,000	5,000	15	-	90	13.5	670	0	-	-
Totals		15		\$93,750					\$7,750			\$270

Total Benefits = \$7,750 - \$270 = \$7,480

TABLE 8

Benefits to Present and New Transient Recreational Craft

Type of Craft	Length (Feet)	No. of Craft	Present Transient Craft (180 Day Season)				New Transient Craft			
			Average Depreciated Value	Boat Days	Percent Return (Gain)	Value of Benefit	Average Depreciated Value	Boat Days	Percent Return	Value of Benefit
<u>Recreational Craft</u>										
Cruisers	31-60	525	\$27,000	1,500	0.8	\$1,800	\$27,000	135	7.2	\$1,460
Cruisers	61-100	48	84,000	240	0.8	900	84,000	22	7.2	740
Aux. Sail	31-40	24	19,000	72	0.8	60	19,000	6	7.2	50
Aux. Sail	41-60	24	25,000	120	0.8	130	25,000	11	7.2	110
<u>Charter Boats</u>										
Cruisers	36-50	12	5,000	36	1.5	10	5,000	3	13.5	10
Totals		633				\$2,900				\$2,370

56. Shore Protection Benefits from Watch Hill Cove Improvements. - Recurring damages occur to property around the shore of Watch Hill Cove from wave attack. The property which belongs to the Watch Hill Fire District consists of piers, wharf, seawalls, walks and park. The Watch Hill Fire District has spent an average of \$1,000 per year for repair of damages. The shelter from the proposed breakwater and enlarged jetty will reduce wave attack and damages. It is estimated that the benefit from reduction of damages will amount to \$750 per year.

57. Benefits from Reduction of Shoaling from Closure of Sandy Point Breach. - Since occurrence of the breach through Sandy Point, the tip of the point has grown northward at an increased rate and it has encroached upon the Federally maintained navigation channel at the entrance to Little Narragansett Bay. The increase in the rate of growth is attributed to the decrease in tidal currents in the entrance due to the existence of the breach. Closure of the breach will therefore reduce the rate of growth and the consequent shoaling of the navigation channel. The reduction in the shoaling is estimated as a part of the present shoaling represented by the ratio of the increase in rate of growth since breaching to the total rate of growth since breaching. Since the rate of growth prior to breaching was 31 feet per year and after breaching, 43 feet per year this ratio is $12/43$. Comparative surveys of the entrance channel made in May 1955 and September 1957 indicate that the present rate of shoaling is 4,100 cubic yards per year. The decrease in rate of shoaling by closure of the breach is estimated as $12/43 \times 4,100$ or 1,100 cubic yards per year. The benefit is evaluated as a reduction of 1,100 cubic yards of maintenance dredging per year at \$2.00 equal to \$2,200 per year.

58. Classification of Benefits. - All benefits have been classified as general or local in nature. Benefits from recreational craft have been classified as 50 percent general and 50 percent local. Benefits from shore protection have been classified as $33-1/3$ percent general and $66-2/3$ percent local. Benefits from reduction of shoaling of the navigation channel have been classified as 100 percent general. The percentage of local benefits to total benefits has been determined for use as a basis for computing the share of the total cost of the project to be borne by local interests. The classification of benefits is shown in Tables 9 and 10.

TABLE 9

Benefits from Watch Hill Cove Improvements

Source of Benefit	General	Local	Total
Existing Locally based recreational craft benefit from jetty and breakwater.	\$4,020	\$4,020	\$8,040
New locally based recreational craft benefit from anchorage extension.	3,740	3,740	7,480
Existing transient recreational craft benefit from jetty and breakwater.	1,450	1,450	2,900
New transient recreational craft benefit from anchorage extension.	1,185	1,185	2,370
Shore Protection	250	500	750
Total	\$10,645	\$10,895	\$21,540
Percentage of Total	49	51	100

TABLE 10

Benefits from Closure of Sandy Point Breach

Source of Benefit	General	Local	Total
Reduction of shoaling of Little Narragansett Bay entrance channel	\$2,200	0	\$2,200
Percentage of Total	100	0	100

APPORTIONMENT OF COSTS AMONG INTERESTS

59. The apportionment of the navigation improvement costs to be borne by the United States and local interests has been computed as 49 percent Federal and 51 percent local for the proposed improvements at Watch Hill Cove and 100 percent Federal for closure of the Sandy Point breach. The apportionment is commensurate with the percentage of the general and local benefits to be derived. The costs for the Watch Hill Cove improvements include construction of a 400-foot breakwater, a 100-foot landward extension and raising of the existing jetty and dredging a 1.75 acre extension of the anchorage to a 6-foot depth. The costs for closure of the Sandy Point breach are computed based on using either sand fill or a rock dike. The apportionment does not include lands, easements and rights-of-way which local interests are required to provide at their own expense since these costs are considered to be self-liquidating. The apportionment of costs based on October 1959 price levels is computed below:

First Costs of Watch Hill Cove Improvements (From Paragraph 53)

Estimated Project Costs

Construction of breakwater, jetty enlargement and anchorage extension by Corps of Engineers with Federal and non-Federal funds.	\$200,000
Preauthorization Study Costs	3,000
Aids to Navigation (U.S. Coast Guard)	6,000
Total Project Costs	<u>\$209,000</u>

Apportionment of First Costs

Federal

Corps of Engineers (0.49 x \$200,000)	\$98,000
Preauthorization Study Costs	3,000
U.S. Coast Guard	6,000
Total Federal Costs	<u>\$107,000</u>

Non-Federal

Cash contribution by local interests (0.51 x \$200,000)	<u>\$102,000</u>
Total Project Costs	<u>\$209,000</u>

First Costs of Sand Fill Closure of Sandy Point Breach (From Paragraph 53)

Estimated Project Costs

Placement of sand fill (Corps of Engineers)	\$630,000
Preauthorization study costs	3,000
Total Project Costs	<u>\$633,000</u>

Apportionment of First Costs. - All computed benefits are general.
Therefore all first costs for the sand fill closure plan are apportioned as Federal.

First Costs of Rock Dike Closure of Sandy Point Breach (From Paragraph 53)

Estimated Project Costs

Construction of rock dike	\$305,000
Preauthorization study costs	3,000
Total Project Costs	<u>\$308,000</u>

Apportionment of First Costs. - All computed benefits are general.
Therefore all first costs listed for the rock dike closure plan are apportioned as Federal.

ESTIMATES OF ANNUAL CHARGES

60. The estimated annual charges have been computed using an assumed project life of 50 years, an interest rate of 2.5 percent for Federal charges and 3.5 percent for non-Federal charges. The annual charges are based on the Federal and non-Federal apportionment of costs in the preceding paragraph. Annual maintenance costs have been included entirely as a Federal annual charge. Estimates are based on prices prevailing in October 1959.

Annual Charges from Watch Hill Cove Improvements

Federal

Interest (0.025) (\$107,000)	\$2,700
Amortization (0.01026) (\$107,000)	1,100
Maintenance	
Dredging 900 c.y. @ \$2.00	1,800
Breakwater and jetty repairs, 115 tons @ \$10.00	1,150
Aids to Navigation	300
Total Federal Annual Charges	<u>\$7,050</u>

Non-Federal

Interest (0.035) (\$102,000)	\$3,570
Amortization (0.00763) (\$102,000)	780
Total Non-Federal Annual Charges	<u>\$4,350</u>

Total Annual Charges	\$11,400
----------------------	----------

Annual Charges from Sand Fill Closure of Sandy Point Breach

Federal

Interest (0.025) (\$633,000)	\$15,820
Amortization (0.01026) (\$633,000)	6,500
Maintenance	
3,000 c.y. fill @ \$2.00	6,000
Total Annual Charges	<u>\$28,320</u>

Annual Charges from Rock Dike Closure of Sandy Point Breach

Federal

Interest (0.025) (\$308,000)	\$7,700
Amortization (0.01026) (\$308,000)	3,160
Maintenance	
Dike repairs, 300 tons rock @ \$10.00	3,000
Total Annual Charges	<u>\$13,860</u>

COMPARISON OF BENEFITS TO COSTS

61. The estimated annual benefits and annual costs and the ratio of benefits to costs for the Watch Hill Cove improvements and for the two plans for closure of the Sandy Point breach are included in Table 11.

TABLE 11

Comparison of Benefits to Costs

	Watch Hill Cove Improvements	Sandy Point Breach Closure	
		Sand Fill	Rock Dike
Estimated Annual Benefits	\$21,540	\$2,200	\$2,200
Estimated Annual Costs	11,400	28,320	13,860
Ratio of Benefits to Costs	1.9	0.1	0.2

PROPOSED LOCAL COOPERATION

62. The benefits to be derived from the proposed improvements in Watch Hill Cove are part general and part local in nature. It is considered that local interests should be required to bear a share of these improvements in proportion to the percentage of local benefits involved. The apportionment of costs between the United States and local interests based on the percentage of local benefits requires that local interests make a cash contribution of 51 percent of the proposed construction of the breakwater, the jetty enlargement and the anchorage extension. The local cash contribution is presently estimated at \$102,000.

63. Local interests should also be required to (a) provide without cost to the United States all necessary lands, easements and rights-of-way for the construction and maintenance of the project when and as required; (b) hold and save the United States free from property damages that may result from the construction and maintenance of the project; (c) maintain without cost to the United States necessary mooring facilities and utilities including a public landing with suitable supply facilities open to all on equal terms; and (d) provide without cost to the United States suitable disposal areas.

64. Coordination with Other Agencies. - All Federal, State and local agencies known to have an interest in the development and use of the waterway were notified of the conduct of the study and the public hearing held at Westerly, Rhode Island on June 16, 1958. The hearing was attended by a United States Congressman, members of the State Legislature, officials of the Town of Westerly and the Watch Hill Fire District, members of the Shore Development Committee of the Westerly-

Pawcatuck Chamber of Commerce, representatives of the Watch Hill and Westerly Yacht Clubs, businessmen and interested private individuals. During the study, meetings were held with the Shore Development Committee, officials of the Westerly and the Watch Hill Fire District and other interested parties at which the needs for improvement and the plans considered were discussed. The plan recommended in this report follows the general desires of local people as determined from these meetings. The Watch Hill Fire District, the Town of Westerly and the Division of Harbors and Rivers of the Rhode Island Department of Public Works were advised in writing of the final plan for the proposed improvements and their comments were requested, particularly in regard to their ability and willingness to assume the required conditions of local cooperation. The Watch Hill Fire District passed a resolution at its annual meeting on July 11, 1959 approving of the recommended plan. The Westerly Town Council advised that it was unanimously and wholeheartedly in favor of the recommended plan and that it would fulfill the conditions of local cooperation to the best of its ability, the contribution of funds being subject to approval of the Financial Town Meeting. The Division of Harbors and Rivers of the Rhode Island Department of Public Works expressed approval of the final plan as the most logical plan of improvement which would produce the desired results and keep the cost within a reasonable limit. It stated that the State cannot at this time be committed to share in the cost of the project but since it has in the past made funds available to assist in similar projects, it perhaps can be assumed that this policy will be followed in this case. In regard to the other conditions of local cooperation, it was stated to be the policy of the State to require the local community, in this case the Town of Westerly, to give the assurance to the Federal Government. The United States Coast Guard was advised of the proposed improvements and this agency furnished estimates of first costs and maintenance costs for required navigation aids. The Regional Director of United States Fish and Wildlife Service and the Administrator of the Rhode Island Division of Fish and Game were advised concerning the proposed improvements and requested to comment on aspects pertaining to their interests. The Rhode Island Division of Fish and Game was of the opinion that the proposed improvement would have no adverse effect on shellfish and no effect on wildlife habitat. The United States Fish and Wildlife Service concluded that fish and wildlife effects will be negligible.

CONCLUSIONS

65. It is concluded that recreational navigation needs at Watch Hill Cove, Westerly, Rhode Island justify a modification of the existing project to provide for a new breakwater 400 feet long, raising the height and extending the existing jetty landward 100 feet, and enlarging the existing anchorage to provide an additional 1.75 acres at a depth of 6 feet. The total cost of the above construction

is estimated at \$200,000 exclusive of navigation aids, preauthorization study costs, necessary lands, easements, rights-of-way and disposal areas. The benefit-cost ratio based principally on benefits to recreational craft but including incidental shore protection benefits is 1.9. A local cash contribution of 51 percent of the cost of construction should be required in view of the percentage of local benefits to be derived from the project. The presently estimated local cash contribution is \$102,000. The share of the first cost of construction to be borne by the United States is estimated at \$98,000. Funds for the entire project should be appropriated in one fiscal year.

66. It is concluded that evaluated benefits consisting of reduction of the cost of maintaining the navigation channel at the entrance to Little Narragansett Bay north of Sandy Point do not justify closure of the breach through Sandy Point at the present time. Plans considered provide for closure of the breach by construction of a sand dike or by construction of a stone dike. The total construction cost for closure of the breach with a sand dike is estimated at \$630,000 and the benefit-cost ratio is 0.1. The total cost of construction for closure with a stone dike is estimated at \$305,000 and the benefit-cost ratio is 0.2.

67. It is also concluded that it is not advisable to consider widening of the Pawcatuck River channel in the vicinity of the Westerly Yacht Club and the removal of shoals between this channel and the club due to the lack of a public landing or other facilities for general public use of the area.

68. Additional information on recommended and alternative projects called for by Senate Resolution 148, 85th Congress, 1st Session adopted 28 January 1958, is contained in Attachment 1 to this report.

RECOMMENDATIONS

69. It is recommended that the existing project for Pawcatuck River, Rhode Island and Connecticut, be modified to provide for construction of the following all as shown on Plates 1 and 3:

a. A stone breakwater across Watch Hill Cove entrance starting about 75 feet off Batteys Point and extending to a point on the opposite side of the channel from the end of the existing jetty, 400 feet long with 5-foot top width, top elevation 8.0 feet above mean low water and side slopes of 1 on 1.5.

b. Landward extension of the Watch Hill Cove jetty from its present length of 550 feet to a length of 650 feet and enlargement of the jetty section to a 5-foot top width, top elevation 8.0 feet above mean low water and sides slopes of 1 on 1.5.

c. Extension of the existing anchorage along the south side of Watch Hill Cove by dredging an additional 1.75 acres to a 6-foot depth.

70. The total estimated cost of construction of the above work is \$200,000 to be borne jointly by the United States and local interests. The estimated cost to be borne by the United States is \$98,000 with \$2,950 annually for maintenance, exclusive of costs of the preauthorization study and of aids to navigation.

71. Modification of the project is recommended subject to the conditions that local interests:

a. Make a cash contribution of 51 percent of the initial construction cost. The present estimated amount of the contribution is \$102,000.

b. Provide without cost to the United States all necessary lands, easements and rights-of-way for the construction and maintenance of the project when and as required.

c. Hold and save the United States free from damages that may result from the construction and maintenance of the project.

d. Maintain without cost to the United States necessary mooring facilities and utilities including a public landing with suitable supply facilities open to all on equal terms.

e. Provide suitable disposal areas for dredged material without cost to the United States.

ALDEN K. SIBLEY
Brigadier General, U. S. Army
Division Engineer

4 Incls
Attachment 1
Plates 1 - 3

ATTACHMENT 1

Little Narragansett Bay and Watch Hill Cove

Pawcatuck River Project Rhode Island and Connecticut

Information Called for by Senate Resolution 148, 85th Congress
Adopted 28 January 1958

1. Navigation Problem. Little Narragansett Bay is located at the Rhode Island-Connecticut boundary at the mouth of the Pawcatuck River in the Town of Westerly. It is separated from Block Island Sound to the south by Napatree Beach and from Fishers Island Sound to the west by a breached sand spit known as Sandy Point. Watch Hill Cove is located in the southeast corner of Little Narragansett Bay. The entrance channel from Fishers Island Sound into Little Narragansett Bay passes north of Sandy Point, and along the north side of the bay to the mouth of the Pawcatuck River, one branch of the channel passing northward up the river the other southward to Watch Hill Cove. The mean range of tide is 2.7 feet.

2. The principal problems exist at Watch Hill Cove. They consist of (a) the need for better protection of dock and anchorage areas against west and northwest winds, (b) shoaling of the south side of the cove by drifting sand and (c) the need for additional anchorage area, the present anchorage now being crowded throughout the season. A problem has also been created by breaching of Sandy Point. This has resulted in an increase in the rate of shoaling of the navigation channel located north of Sandy Point and also of Little Narragansett Bay.

3. Improvements Considered. The plan of improvement considered for Watch Hill Cove agrees with that desired by local interests. It consists of construction of a breakwater across the entrance of the cove, enlargement and extension of the existing jetty and dredging of additional anchorage area along the south side of the cove. Consideration was also given to closure of the Sandy Point breach by construction of a stone or a sand fill dike.

4. Recommended Improvement. It was recommended that a breakwater 400 feet long with a top elevation of 8.0 feet, top width of 5 feet and side slopes of 1 on 1.5 be constructed across the Watch Hill Cove entrance, that the existing Watch Hill Cove jetty be enlarged to the same dimensions as the breakwater and extended 100 feet landward and that the existing Watch Hill Cove anchorage be extended by dredging 1.75 acres along its southside to a depth of 6 feet.

5. First Costs. The estimated first cost of the recommended improvement based on January 1959 price levels is as follows:

Federal	\$98,000*
Non-Federal	102,000
Total	\$200,000*

*Excludes \$3,000 in preauthorization study costs and \$6,000 for navigation aids.

6. Annual Costs and Benefits. Average annual costs and benefits for the recommended improvement computed on the basis of an economic life of 50 years and an interest rate of $2\frac{1}{2}$ percent for Federal costs and $3\frac{1}{2}$ percent for non-Federal costs are as follows:

<u>Average Annual Costs</u>	<u>Federal</u>	<u>Non-Federal</u>	<u>Total</u>
Interest and Amortization	\$3,800	\$4,350	\$8,150
Maintenance	3,250*	-	3,250
Total	\$7,050	\$4,350	\$11,400

*Includes \$300 for maintenance of navigation aids.

Average Annual Benefits

Benefits to Recreational Navigation	\$20,790
Shore Protection	750
Total	\$21,540

Ratio of Benefits to Cost - 1.9

7. Apportionment of Costs. The costs of the recommended improvement are apportioned between the Federal Government and local interests in accordance with the percentage of the general and local benefits to be derived as is normally done for projects of this type. Local interests are expected to (a) contribute in cash 51 percent of the first cost of construction, such contribution, presently estimated at \$102,000 (b) provide without cost to the United States all necessary lands, easements and rights-of-way for the construction and maintenance of the project when and as required, (c) hold and save the United States free from damages that may result from the construction and maintenance of the project, (d) maintain without cost to the United States necessary mooring facilities and utilities including a public landing with suitable facilities open to all on equal terms, (e) provide suitable disposal areas for dredged material without cost to the United States.

8. Discussion. The improvements recommended for Watch Hill Cove provide a logical and economically feasible means of meeting the needs of navigation in the harbor. The improvements are considered justified.

Other improvements considered for Sandy Point provide a practicable method of closing the breach but the benefits to be derived are not sufficient to justify the projects. First and annual costs, benefits and ratio of benefits to costs for the two plans for closure of the breach based on a 50 year economic life and an interest rate of $2\frac{1}{2}$ percent are as follows:

	<u>Sand Fill Dike</u>	<u>Stone Dike</u>
<u>First Costs</u>	\$633,000	\$308,000
<u>Annual costs</u>		
Interest and amortization	22,320	10,860
Maintenance	<u>6,000</u>	<u>3,000</u>
Total Annual Costs	\$28,320	\$13,860
Annual Benefits	\$2,200	\$2,200
Ratio of Benefits to Costs	0.1	0.2

Analysis on the basis of an economic life of 100 years would not result in modification of the findings in the report. The benefit-cost ratio for the Watch Hill Cove improvements would increase from 1.9 to 2.2. The benefit-cost ratios for the closure of the Sandy Point breach, computed to the nearest tenth, would not exceed those listed above which are based on a 50-year economic life.





